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DIRECTING STUDY FOR MASTERY

H. L. MILLER AND DOROTHY JOHNSON
Wisconsin High School, University of Wisconsin

The purpose of this study of the teaching process is to present briefly a plan of organization and procedure in which a sense of mastery and power may be gained by students, and also to suggest ways of dealing with individuals of varying achievements in the same class group. Two subjects, geometry and French, are used to illustrate the study.

It is an obvious and distressing fact that the lower ranges of our school marks are evidences or judgments of the students' incapacity. The higher marks granted are not equally clear evidences of definable levels of achievement. The differences between fair and good, good and excellent, etc.; are by no means clear to students, teachers, and parents. An exact, verifiable, and quantitative determination of different school marks is not sought in our argument, but there is insistence on mastery, and there is insistence on some means of checking results. The "gentleman's mark" has never indicated mastery; it is a "get-by" mark. There is in it a curious psychology, a sort of protective coloring. Many a so-called student cannot tolerate the thought of exhibiting the virtues of scholarly interests. On the whole, the lowest third, if not the lower half, of school marks may carry practically no guaranty of mastery.

We have also the eternal problem of individual differences; to meet this, sectioning classes is suggested. That is only a partial solution. Our suggestions are made on the theory that the problem of individual differences can be adequately met only by regarding the student, rather than the class group, as the educative unit. Whenever potential mathematicians or linguists are programmed for the great adventure into geometry or French, or any other subject, our tentative thesis is that they may be directed in their respective adventures with all sorts of abilities in the same group.

We have attempted to transcend the movement for minimum essentials of content. The minimum essential inevitably becomes the maximum necessity in a system of education in which the dominant emphasis is on piling up credits. Instead of a least common denominator of practical and social information for any class group or administrative unit, the emphasis is, according to our plan, shifted to some highest common multiple of principles in which and by which to express a community of interests. The drive is toward individual mastery and through self-expression to a unity, not a uniformity, of interests.

The marks employed in rating students in our classes are N.M. (no mastery), fair, good, and excellent.

The work of the two courses included in this presentation has been arranged in units which we call challenges. Projects hardly serves as a term adequate to the description of the scheme. The daily lesson assignment is not employed. Lessons are not "said" in the conventional way. A challenge engages the class for varied periods of time—two weeks to five or six weeks—depending on the nature of the problem. The first challenge in the geometry class, Book I, was continued fourteen weeks. Concerted attention of the class is had when the elucidation or development of some organizing principle or process is conceived to be of general interest and value, when drill or discussion is desired, when economical teaching is employed to clear up difficulties for a considerable number of the group, or when "socialization" (after the constitution is adopted) seems to be the quest. The teacher is conceived to be a director of activities. He is concerned with the problem of guidance in the learning process. He is a consulting expert. He is there to co-ordinate activity, to stimulate, to arouse curiosity, to guide mental life. He must check results. He must create a controlled environment in which the work spirit may prevail.

An ascending scale of mastery is provided. Each statement of work above the first is cumulative. Three blocks of material are laid out in each challenge. The first block contains the organizing principles and essential processes in the challenge. The second and third blocks contain all of the first block and such elaborations in each case as the subject warrants.

In order to receive a mark of fair, the student must make a mark of excellent in the first block of material; that is to say, there is no recognition of a fair or a good mastery of the material; it must be mastered in its completeness. Fair describes the extent to which the student goes. The quality of understanding may be quite as adequate as that of a student with a higher mark. By the same token, the student must make a mark of excellent in the second block of material in order to receive a mark of good in the challenge. In the third block the student earns a mark of excellent by doing it on the basis of excellence.

To illustrate: In a class of thirty-nine pupils in geometry (tenth grade) "Areas of Polygons" was the challenge. Twelve days was the time allotted to this challenge.

I. In order to receive a mark of fair the student was aware that he would have to make a mark of excellent in a mastery of the following: measurement of equal areas; fourteen propositions (theorems and problems) clearly specified; a statement of ten corollaries; at least two simple exercises illustrative of such of the propositions as carried applications; facility in the applications of the law of right triangles.

II. In order to receive a mark of good the student was aware that he would have to make a mark of excellent in the following: all of I and in addition at least sixty exercises among those which accompany the propositions as they are developed. Certain exercises were marked for omission.

III. In order to receive a mark of excellent the student was aware that he would have to make a mark of excellent in the following: all of I and II and in addition at least forty supplementary exercises listed in the back of the book (Wells and Hart) on "Areas of Polygons."

Now a corrective and a caution. The teaching process is not a factory problem. These blocks of work carry an unfortunate implication. Piece work is suggested, but mastery cannot be secured in that way. The child does not learn addition or factoring or any other process in any subject by gaining temporary skill in it and by checking it off as a finished job. All processes in education are indeterminate. Addition, factoring, sentence idea, develop-

ment—in brief, all processes—are to be conceived of, not as so many jobs to be finished under schedules, but as processes, as the mind's ways of organizing facts. The child begins a process, addition or factoring, for example; the youth carries on not only by using the process but by extending and elaborating it, actually learning it in a progressively deeper sense. Hence the fallacy in the present movement in educational practice of attempting to get certain jobs finished, as if they were done when they appear to be done.

These blocks—I, II, and III—are not to be thought of in a rigid sequence. They constitute a real synthesis in every challenge. We all know, for example, that the case idea in English grammar may not begin to clarify until the student grips its significance in a foreign language. Just so a fundamental principle or process in I may not be at all clear until it is comprehended in some part of II or III. No attempt is made at separation and cleavage in these requirements for fair, good, and excellent. They are all aspects of a deeper unity. They may be conceived of as foci, in a sense, around which pupils of varying powers may concentrate attention with a view to setting forth rather definite tasks for final emphasis. During the teaching and learning processes all or any part of the materials of instruction may be employed throughout the challenge. Section I is not finished and checked off before II is begun. Section I is used and elaborated constantly in all of II and III. Also Section I may not be comprehended until principles and processes are seen in the exercises in II and III. In II and III the exercises are used in the teaching process to illustrate principles. All pupils participate in a common drive in exercises employed for the purposes of drill and discussion and in planning methods of attack. All possible devices are used in the effort to secure a real mastery.

It will be observed that Section I contains the essential organizing principles and processes in the challenge. The student either learns how to prove "that the area of a triangle equals one-half the product of its base and altitude" or does not learn it. He either learns the demonstration of the Pythagorean theorem or does not learn it, etc. He is not given a mark indicating partial success or failure in doing these things. Until he has mastered them no

passing mark is given. The marks of fair for I, good for II, and excellent for III are all marks indicative of mastery. There is or there is not an understanding of the section of the assignment under consideration. The student either does the thing or does not do it. Until he does it the mark of N.M. (no mastery) is used to characterize his status.

In this particular class the challenges were closed with examinations. These examinations were given both to check or verify other means of determining mastery and to demonstrate the fallacy of a soft pedagogy in regard to examinations. The opportunity of Saturday mornings was offered for these examinations. Three or four hours of uninterrupted application were available. Most of the students came Saturday mornings for these examinations. Twelve "doable" things were set each time, four within each of the three blocks as indicated. Twenty-five per cent was allowed for each exercise or proposition demonstrated. The student working for a mark of excellent was expected to reach 300 per cent; the student satisfied with a fair had to do at least four in block I. Each challenge was presented after the fashion illustrated.¹

There are many reasons—some only good reasons, others real reasons—why some pupils may be expected to earn only a fair in their studies. There is the background—a whole series of problems in a student's antecedents. There is the question of attitudes, temperament, and industry. There is the problem of available time for a difficult study.

A CHALLENGE IN BEGINNING FRENCH (NINTH GRADE) COVERING A
PERIOD OF FOUR TO FIVE WEEKS

I. Requirements for fair:

1. Memory work:

a) *La Grenouille*

2. Composition:

a) Written—review any story already read and base on it a play, conversation, description, etc., of 100 words.

¹ Lest anyone conclude that as little work as possible will be done in any event, this particular class in geometry adopted the following safety-first rule. "By doing more than sixty in Section II and more than forty in Section III, you will thereby be taking out insurance against the day of your examination. Extra work of such character will compensate you for certain accidents on examination day. *Verbum sapientibus est satis.*"

b) Oral—answer any questions based on the following stories in Longman: 6-7-12-13-16-19-21-22-23-26-28-29-34-36-38-40.

3. Translation:

a) English to French—any one of the following, 6-7-8-9-10-14-17-18-27-28-29-30-31-35-36-37-39, the last number.

b) French to English—any one of the following texts: 14-15-17-18-20-24-25-27-30-32-33-35-37-39.

4. Reading:

a) Prepared—five lines

b) Sight—five lines

In order to earn a mark of fair, a mark of excellent must be earned in I.

II. Requirements for good:

1. Memory work

a) *La Grenouille* and *Le Corbeau et le Renard*

2. Composition:

a) Written—read a story outside of class and write a synopsis or conversation based on text, etc., 150 words.

b) Oral—answer any questions on any story in *Petits Contes*.

3. Translation:

a) English to French—any in the Longman text

b) French to English—sight

4. Reading:

a) Prepared—ten lines

b) Sight—five lines

In order to earn a mark of good, a mark of excellent must be earned in II.

III. Requirements for excellent:

1. Memory work:

a) *La Grenouille*, *Le Corbeau et le Renard*, also *La Cigale et la Fourmi*, or the presentation before the class of some already prepared play.

2. Composition:

a) Written—write in French 150-200 words on the geography of France and its history, descriptions of landscapes, lives of great men, etc.

3. Translation:

a) English to French—sight—some five lines

b) French to English—sight—some twenty lines

4. Reading:

a) Prepared—fifteen lines

b) Sight—ten lines

In order to earn a mark of excellent, a mark of excellent must be earned in III.

GENERAL INFORMATION

1. No one may come up for examination on any of the requirements in one of the advanced groups until all of the requirements of the previous group or groups have been complied with.

2. In sections where one out of a number of prepared answers is to be asked for, the number will be drawn by lot at the time of the examination and must be answered immediately.

3. The word "prepared" under "Reading" indicates that students are to take the required number of lines from any French text they desire; they are to study these lines so as to be able to read fluently and correctly.

4. All outside texts must be approved before work on them can be begun.

We are laboring under no illusion about mastery. It is exceedingly difficult to delimit any aspect of it. The ability to recognize or repeat a simple element in a relatively simple situation is not a final criterion of ability to use or even recognize that simple element in a more complex situation. Again, inability to recognize or know a simple element in a simple situation is not final evidence of inability to recognize it in a learning synthesis. As the Japanese proverb runs, "Scissors and servants are in accordance with the users." The real question is, When and under what circumstances does one know a thing?

It may be urged that we have made no substantial distinctions in these requirements for fair, good, and excellent. Why not say "Mastery is mastery" and be done with it? The answer is, human nature. Teaching is done on the "ticklish skin of poor humanity."

The quantitative side of education is important. Yet we are not relying on a statistical accounting merely in determining these ratings. The amount of work done is an important symptom. Yet we are not always sure that understanding and appreciation bear a high correlation with quantitative results. We are prepared to reward or at least recognize industry. It is not possible to state just the number of exercises that will insure understanding and mastery of addition, factoring, the subjunctive mood, or what not. A fixed minimum of pages on American institutions would hardly be considered a guaranty of sound Americanism. This is by no means the whole argument.

The reactions of the students in these two classes would seem to support the view that a sense of mastery and adequacy in the block of material set out as a basis upon which to earn a mark of fair stimulates pupils to do more than the requirements. No student in these two groups was content to work in the first block only. In fact, we found it necessary to advise some of the students to confine their work to blocks I and II and make sure of mastery there. The psychology of the situation would seem to be hopeful. Whenever a real sense of mastery is gained, the basis is laid for scholarly interests. The disposition to "get by" with bluffing and indirection disappeared. In fact, the boy who felt most keenly a mistake was the boy who came out second in one of the examinations in geometry. He made only 290 per cent out of a possible 300 per cent. The entire class sympathized with him in his mortification.

It is not contended here that earning credits did not enter as a controlling factor. The main points we desire to make are (a) that a sense of mastery can be attained by practically all pupils who may be induced to catch the contagion of work, (b) that individual differences can be recognized in a class perhaps to the advantage of every member of the group, and (c) that school marks gain a new significance when there is clear indication that every passing mark carries mastery of something very definitely worked out and adequately checked.

To be sure, we have left to the teacher the responsibility of determining what shall constitute the requirements for each block of material and also the criteria which shall be employed in determining mastery in the same. It is assumed that the teacher must be the final arbiter in passing judgment on the work of students in respect to the ratings given them. The teacher must be the judge in determining what standards shall be used in his class in arriving at a basis of judgment for excellence. No single system or device can be employed in a mechanical way in the determination of an adequate mastery. Such standards as are employed cannot be conceived of as absolute or final.

This presentation is intended to set forth some aspects of the very difficult problem of mastery. We have gone not into the

problems of the learning processes; nor have we sought to shed any light on the ways in which students master their work. We are fully aware of the fact that not all original exercises were worked out independently. We do not know how much creative thinking has been done. We have frankly been engaged in the task of checking up the performances of students in terms of their ability to present pieces of work with accuracy and understanding. The deeper questions of power and creativeness have hardly been touched at all.

In presenting the few facts recited in this study we have sought to give them their setting in a philosophy of education and life. The educator who boasts that he has no patience with a philosophy of education is usually defending, unwittingly perhaps, a very definite philosophy about human nature. It is easy to assert a certain fatalism or pedagogical determinism in educational discussion today. The physicist is no longer holding to a belief in absolute motion, space, or time. The length of his meter stick depends on the system of velocities in which the meter stick is located. The physicists, the chemists, and the natural scientists generally are now expressing curiosity about energy, gravitation, motion, electromagnetism, and all sorts of concepts which only yesterday were accepted as absolute. When students are induced to think about these things with a wholesome curiosity, instead of accepting all sorts of ready-made ideas, a new day in education will come. It is a curious turn of events to find in the social sciences a considerable amount of the older dogmatism of the "exact" sciences. We find it in the postulates about human nature, instincts, capacity, etc.

It is now common knowledge that the outer wheel of the automobile travels faster than the inner wheel in turning a corner. The differential takes care of all that. It would be disastrous if the wheels in different speeds had to be separated from the car in turning a corner. Different rates of motion are provided for in the unity of the car. In teaching we find ourselves always "at the fork of the road."

We have also the figure of several transmissions ahead which we may borrow from the automobile. There are obviously differ-

ent "makes" of cars, but we do not build separate and exclusive highways for these machines. The real purpose of this analogy is to remind ourselves that individual differences are to be expected in endless differentiation and also that a unity, never a uniformity, of interests is conceivable only as a resultant of variety.

We are not unmindful of the popular psychology which supports the view that there are those who cannot master (learn) geometry, French, or the other thing. Even if it were so, we have no reliable technique by which to discover in advance just who those are who cannot profit by one thing or another.¹ It is refreshing, if disturbing, to find not a few students, testing low, paying good dividends on the investment in education. Moreover, it may be pertinent to remind ourselves that perhaps the most difficult thing in the whole range of mathematics, comparably speaking, is long division. Society faces this problem with confidence that it can be mastered as a part of the universal mathematical achievement of elementary education. Teachers in the elementary school face the task of long division with courage and determination. The binomial theorem, trigonometric ratios, and demonstrational geometry are all quite simple in comparison with long division. There are, no doubt, illustrations in other subjects just as striking. The easy way, the way too often adopted by mechanical teachers, is to dismiss John Smith from school or college. To cure ourselves of a certain fatalism about folks in the making is one serious aspect of our teaching problem. Another part of the problem is to cure our students of the educate-me-if-you-dare attitude. In brief, our modern task is the improvement of the teaching processes. This study is directed toward that end.

¹ Is the following statement tenable? "The relative permanency of the I.Q. enables us to predict with some degree of approximation the mental level a child will attain by a given age. . . . Facts have been presented which show that the limits of a child's educability can be fairly accurately predicted by means of mental tests given in the first school year. By repeated tests these limits can be determined accurately enough for all practical purposes by the end of the child's fifth or sixth school year. This early, at least, vocational training and vocational guidance should begin." (L. M. Terman, *The Intelligence of School Children*, pp. 157-58, 268-69. Boston: Houghton Mifflin Co., 1919.)